GeoPackage

> **OGC Standard published 2014**

> **"An open standard non-proprietary platform-independent GeoPackage container for distribution and direct use of all kinds of geospatial data"**

> **Vector and Raster data stored in SQLite file DB**

> **GeoPackage = ~SpatiaLite + ~MBTiles + Metadata**

SQLite

- **Self-contained, single-file, cross-platform, serverless, transactional, open source RDBMS container**

- **Well-proven and widely used**
  - Version 1.0: 17.8.2000
  - Android, Mozilla, Apple, Adobe, Skype, ...

- **Embedded database**
  - File based, no server process
  - C programming language
  - Access via library (<275KiB)
  - SQL API
  - Dynamic type system

SQLite

- **Good SQL-92 compatibilty**
  - Joins, views, triggers
  - Transactions

- **Locking:**
  - Write ahead logging (WAL) introduced in 3.7
  - Before that write access locked database also for reading

- **GeoPackage based on SQLite 3**

- **Maximum size of a GeoPackage file ~140TB**

GeoPackage introduction

- **Spatial extension to SQLite embedded database**

- **Like PostGIS extends PostgreSQL**

- **Single file storage, SQL support**

- **Spatial data types & functions**

- **Multiple raster and tile pyramid data sets**

GeoPackage data

- **OGC Simple Feature types (WKT, WKB)**
  - Point, MultiPoint
  - LineString, MultiLineString
  - Polygon, MultiPolygon
  - XY, XYZ, XYM, XYZM

- **WKB based BLOB**

- **One geometry column per table**

- **R*Tree index tables**

- **Raster tile sets (PNG, JPEG)**

```
SELECT t2.Name, t2.Peoples,
    ST_Distance(t1.geom, t2.geom) AS Distance
FROM Towns AS t1, Towns AS t2
WHERE t1.Name = 'Firenze' AND
ST_Distance(t1.geom, t2.geom) < 10000;
```

Raster

- **Multiple tile set tables**

- **Extension of MBTiles specification**
  - Widely used for OSM tiles download & offline storage

```
sqlite> SELECT * FROM tiles;

zoom_level | tile_column | tile_row | tile_data
5          | 13          | 23       | [PNG data]
5          | 13          | 24       | [PNG data]
5          | 14          | 23       | [PNG data]
5          | 14          | 24       | [PNG data]
5          | 15          | 25       | [PNG data]
```

Metadata

- *gpkg_contents:* list of geospatial contents

- *gpkg_data_columns:* descriptive information about columns in user vector feature and tile matrix data tables

- *gpkg_geometry_columns:* vector data

- *gpkg_tile_matrix_metadata:* raster data

- *gpkg_spatial_ref_sys:* coordinate reference system definitions

- *gpkg_metadata:* XML metadata

- *gpkg_metadata_reference:* row level metadata

Metadata (Extensions)

> *gpkg_extension:* supported functionality

> *gpkg_rtree_index:* available index tables

> *gpkg_geometry_type_trigger:* type checks

> More formats: WEBP, TIFF, NITF

GeoPackage Advantages

> **Data exchange *and* direct use**

> **Single file**

> **Vector *and* raster**

> **From mobile to server**

> **Custom extensions mechanism**

> **Promote GeoPackage**
> > Provide GeoPackage
> > Ask for GeoPackage

> **Open Data!**

Thank you! - Questions?

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